

## ON THE INSIDE

Peter V. Minorsky 1185

## HIGH IMPACT

A Transcriptomic Footprint of Reactive Oxygen Species. Aleel K. Grennan 1187

## GENOME ANALYSIS

<sup>[W][OA]</sup>The F-Box Gene Family Is Expanded in Herbaceous Annual Plants Relative to Woody Perennial Plants. Xiaohan Yang, Udaya C. Kalluri, Sara Jawdy, Lee E. Gunter, Tongming Yin, Timothy J. Tschaplinski, David J. Weston, Priya Ranjan, and Gerald A. Tuskan 1189

<sup>[W][OA]</sup>Transcriptome Analyses Show Changes in Gene Expression to Accompany Pollen Germination and Tube Growth in Arabidopsis. Yi Wang, Wen-Zheng Zhang, Lian-Fen Song, Jun-Jie Zou, Zhen Su, and Wei-Hua Wu 1201

## BREAKTHROUGH TECHNOLOGIES

Extremely High-Level and Rapid Transient Protein Production in Plants without the Use of Viral Replication. Frank Sainsbury and George P. Lomonossoff 1212

## SCIENTIFIC CORRESPONDENCE

<sup>[W]</sup>Peroxisomal Localization of Arabidopsis Isopentenyl Diphosphate Isomerases Suggests That Part of the Plant Isoprenoid Mevalonic Acid Pathway Is Compartmentalized to Peroxisomes. Maya Sapir-Mir, Anahit Mett, Eduard Belausov, Shira Tal-Meshulam, Ahuva Frydman, David Gidoni, and Yoram Eyal 1219

## RESEARCH ARTICLES

### BIOCHEMICAL PROCESSES AND MACROMOLECULAR STRUCTURES

Perturbed Lignification Impacts Tree Growth in Hybrid Poplar—A Function of Sink Strength, Vascular Integrity, and Photosynthetic Assimilation. Heather D. Coleman, A. Lacey Samuels, Robert D. Guy, and Shawn D. Mansfield 1229

<sup>[W]</sup>Functional Analysis of the Cellulose Synthase-Like Genes CSLD1, CSLD2, and CSLD4 in Tip-Growing Arabidopsis Cells. Adriana J. Bernal, Cheol-Min Yoo, Marek Mutwil, Jakob Krüger Jensen, Guichuan Hou, Claudia Blaukopf, Iben Sørensen, Elison B. Blancaflor, Henrik Vibe Scheller, and William G.T. Willats 1238

<sup>[W][OA]</sup>Terpene Biosynthesis in Glandular Trichomes of Hop. Guodong Wang, Li Tian, Naveed Aziz, Pierre Broun, Xinbin Dai, Ji He, Andrew King, Patrick X. Zhao, and Richard A. Dixon 1254

<sup>[W][OA]</sup>RNA Interference-Mediated Repression of *MtCCD1* in Mycorrhizal Roots of *Medicago truncatula* Causes Accumulation of C<sub>27</sub> Apocarotenoids, Shedding Light on the Functional Role of CCD1. Daniela S. Floss, Willibald Schliemann, Jürgen Schmidt, Dieter Strack, and Michael H. Walter 1267

Continued on next page

- [W][OA] MAP20, a Microtubule-Associated Protein in the Secondary Cell Walls of Hybrid Aspen, Is a Target of the Cellulose Synthesis Inhibitor 2,6-Dichlorobenzonitrile. *Alex S. Rajangam, Manoj Kumar, Henrik Aspeborg, Gea Guerriero, Lars Arvestad, Podjamas Pansri, Christian J.-L. Brown, Sophia Hober, Kristina Blomqvist, Christina Divne, Ines Ezcurra, Ewa Mellerowicz, Björn Sundberg, Vincent Bulone, and Tuula T. Teeri* 1283
- [C][OA] Catalytic Key Amino Acids and UDP-Sugar Donor Specificity of a Plant Glucuronosyltransferase, UGT94B1: Molecular Modeling Substantiated by Site-Specific Mutagenesis and Biochemical Analyses. *Sarah A. Osmani, Søren Bak, Anne Imberty, Carl Erik Olsen, and Birger Lindberg Møller* 1295
- [W] Further Evidence for the Mandatory Nature of Polysaccharide Debranching for the Aggregation of Semicrystalline Starch and for Overlapping Functions of Debranching Enzymes in Arabidopsis Leaves. *Fabrice Wattebled, Véronique Planchot, Ying Dong, Nicolas Szydlowski, Bruno Pontoire, Aline Devin, Steven Ball, and Christophe D'Hulst* 1309
- [W][OA] A  $\gamma$ -Glutamyl Transpeptidase-Independent Pathway of Glutathione Catabolism to Glutamate via 5-Oxoproline in Arabidopsis. *Naoko Ohkama-Ohtsu, Akira Oikawa, Ping Zhao, Chengbin Xiang, Kazuki Saito, and David J. Oliver* 1603
- [W] Alterations in Cytosolic Glucose-Phosphate Metabolism Affect Structural Features and Biochemical Properties of Starch-Related Heteroglycans. *Joerg Fettke, Adriano Nunes-Nesi, Jessica Alpers, Michal Szkop, Alisdair R. Fernie, and Martin Steup* 1614
- A Stress-Inducible Resveratrol O-Methyltransferase Involved in the Biosynthesis of Pterostilbene in Grapevine. *Laure Schmidlin, Anne Poutaraud, Patricia Claudel, Pere Mestre, Emilce Prado, Maria Santos-Rosa, Sabine Wiedemann-Merdinoglu, Francis Karst, Didier Merdinoglu, and Philippe Hugueney* 1630
- [W][OA] Decreased Expression of Cytosolic Pyruvate Kinase in Potato Tubers Leads to a Decline in Pyruvate Resulting in an in Vivo Repression of the Alternative Oxidase. *Sandra N. Oliver, John E. Lunn, Ewa Urbanczyk-Wochniak, Anna Lytovchenko, Joost T. van Dongen, Benjamin Faix, Elmar Schmälzlin, Alisdair R. Fernie, and Peter Geigenberger* 1640
- BIOENERGETICS AND PHOTOSYNTHESIS**
- [W][OA] Complex I Dysfunction Redirects Cellular and Mitochondrial Metabolism in Arabidopsis. *Marie Garmier, Adam J. Carroll, Etienne Delannoy, Corinne Vallet, David A. Day, Ian D. Small, and A. Harvey Millar* 1324
- [W][OA] Impact of PsbTc on Forward and Back Electron Flow, Assembly, and Phosphorylation Patterns of Photosystem II in Tobacco. *Pavan Umate, Christine Fellerer, Serena Schwenkert, Mikael Zoryan, Lutz A. Eichacker, Abbagani Sadanandam, Itzhak Ohad, Reinhold G. Herrmann, and Jörg Meurer* 1342
- [C] Characterization of Arabidopsis Lines Deficient in GAPC-1, a Cytosolic NAD-Dependent Glyceraldehyde-3-Phosphate Dehydrogenase. *Sebastián P. Rius, Paula Casati, Alberto A. Iglesias, and Diego F. Gomez-Casati* 1655
- CELL BIOLOGY AND SIGNAL TRANSDUCTION**
- [W][OA] Comparative Analyses of Arabidopsis *complex glycan1* Mutants and Genetic Interaction with *staurosporin* and *temperature sensitive3a*. *Julia Frank, Heidi Kaulfürst-Soboll, Stephan Rips, Hisashi Koiwa, and Antje von Schaewen* 1354
- [W][OA] The Pollen Receptor Kinase LePRK2 Mediates Growth-Promoting Signals and Positively Regulates Pollen Germination and Tube Growth. *Dong Zhang, Diego Wengier, Bin Shuai, Cai-Ping Gui, Jorge Muschietti, Sheila McCormick, and Wei-Hua Tang* 1368
- [W][OA] The Mitochondrial Cycle of Arabidopsis Shoot Apical Meristem and Leaf Primordium Meristematic Cells Is Defined by a Perinuclear Tentaculate/Cage-Like Mitochondrion. *José M. Seguí-Simarro, María José Coronado, and L. Andrew Staehelin* 1380
- [C][W][OA] Physiological and Transcriptomic Evidence for a Close Coupling between Chloroplast Ontogeny and Cell Cycle Progression in the Pennate Diatom *Seminavis robusta*. *Jeroen Gillard, Valerie Devos, Marie J.J. Huysman, Lieven De Veylder, Sofie D'Hondt, Cindy Martens, Pieter Vanormelingen, Katrijn Vannerum, Koen Sabbe, Victor A. Chepurnov, Dirk Inzé, Marnik Vuylsteke, and Wim Vyverman* 1394

[W]Molecular Characterization of Organelle-Type Nudix Hydrolases in Arabidopsis. *Takahisa Ogawa, Kazuya Yoshimura, Hiroe Miyake, Kazuya Ishikawa, Daisuke Ito, Noriaki Tanabe, and Shigeru Shigeoka* 1412

Protein Tyrosine Kinases and Protein Tyrosine Phosphatases Are Involved in Abscisic Acid-Dependent Processes in Arabidopsis Seeds and Suspension Cells. *Thanos Ghelis, Gérard Bolbach, Gilles Clodic, Yvette Habricot, Emile Miginiac, Bruno Sotta, and Emmanuelle Jeannette* 1668

## DEVELOPMENT AND HORMONE ACTION

[C][W]Ehd2, a Rice Ortholog of the Maize *INDETERMINATE1* Gene, Promotes Flowering by Up-Regulating Ehd1. *Kazuki Matsubara, Utako Yamanouchi, Zi-Xuan Wang, Yuzo Minobe, Takeshi Izawa, and Masahiro Yano* 1425

[W]Different Hormonal Regulation of Cellular Differentiation and Function in Nucellar Projection and Endosperm Transfer Cells: A Microdissection-Based Transcriptome Study of Young Barley Grains. *Johannes Thiel, Diana Weier, Nese Sreenivasulu, Marc Strickert, Nicola Weichert, Michael Melzer, Tobias Czauderna, Ulrich Wobus, Hans Weber, and Winfriede Weschke* 1436

[W]Functional Specialization of the TRANSPARENT TESTA GLABRA1 Network Allows Differential Hormonal Control of Laminal and Marginal Trichome Initiation in Arabidopsis Rosette Leaves. *Lies Maes, Dirk Inzé, and Alain Goossens* 1453

[W]Diversification of Photoperiodic Response Patterns in a Collection of Early-Flowering Mutants of Arabidopsis. *Sylvie Pouteau, Isabelle Carré, Valérie Gaudin, Valérie Ferret, Delphine Lefebvre, and Melanie Wilson* 1465

[W][OA]Acceleration of Flowering during Shade Avoidance in Arabidopsis Alters the Balance between FLOWERING LOCUS C-Mediated Repression and Photoperiodic Induction of Flowering. *Amanda C. Wollenberg, Bárbara Strasser, Pablo D. Cerdán, and Richard M. Amasino* 1681

## ENVIRONMENTAL STRESS AND ADAPTATION TO STRESS

[W][OA]AtCCX3 Is an Arabidopsis Endomembrane H<sup>+</sup>-Dependent K<sup>+</sup> Transporter. *Jay Morris, Hui Tian, Sunghun Park, Coimbatore S. Sreevidya, John M. Ward, and Kendal D. Hirschi* 1474

## GENETICS, GENOMICS, AND MOLECULAR EVOLUTION

[W][OA]Functional Characterization of the Plastidic Phosphate Translocator Gene Family from the Thermo-Acidophilic Red Alga *Galdieria sulphuraria* Reveals Specific Adaptations of Primary Carbon Partitioning in Green Plants and Red Algae. *Marc Linka, Aziz Jamaï, and Andreas P.M. Weber* 1487

## PLANTS INTERACTING WITH OTHER ORGANISMS

[W]XA27 Depends on an Amino-Terminal Signal-Anchor-Like Sequence to Localize to the Apoplast for Resistance to *Xanthomonas oryzae* pv *oryzae*. *Lifang Wu, Mei Ling Goh, Chellamma Sreekala, and Zhongchao Yin* 1497

[W][OA]Powdery Mildew Resistance Conferred by Loss of the ENHANCED DISEASE RESISTANCE1 Protein Kinase Is Suppressed by a Missense Mutation in KEEP ON GOING, a Regulator of Abscisic Acid Signaling. *Anna Wawrzynska, Katy M. Christiansen, Yinan Lan, Natalie L. Rodibaugh, and Roger W. Innes* 1510

[W][OA]Cell Wall-Bound Invertase Limits Sucrose Export and Is Involved in Symptom Development and Inhibition of Photosynthesis during Compatible Interaction between Tomato and *Xanthomonas campestris* pv *vesicatoria*. *Nurcan Kocal, Uwe Sonnewald, and Sophia Sonnewald* 1523

[W]Nitric Oxide Interacts with Salicylate to Regulate Biphasic Ethylene Production during the Hypersensitive Response. *Luis A.J. Mur, Lucas J.J. Laarhoven, Frans J.M. Harren, Michael A. Hall, and Aileen R. Smith* 1537

[C][W][OA]Root-Secreted Malic Acid Recruits Beneficial Soil Bacteria. *Thimmaraju Rudrappa, Kirk J. Czymmek, Paul W. Paré, and Harsh P. Bais* 1547

[W][OA]The AtrbohD-Mediated Oxidative Burst Elicited by Oligogalacturonides in Arabidopsis Is Dispensable for the Activation of Defense Responses Effective against *Botrytis cinerea*. *Roberta Galletti, Carine Denoux, Stefano Gambetta, Julia Dewdney, Frederick M. Ausubel, Giulia De Lorenzo, and Simone Ferrari* 1695

## WHOLE PLANT AND ECOPHYSIOLOGY

- <sup>[C][OA]</sup>The Regulation of Cell Wall Extensibility during Shade Avoidance: A Study Using Two Contrasting Ecotypes of *Stellaria longipes*. *Rashmi Sasidharan, C.C. Chinnappa, Laurentius A.C.J. Voesenek, and Ronald Pierik* 1557
- <sup>[OA]</sup>Dynamics of Light and Nitrogen Distribution during Grain Filling within Wheat Canopy. *Jessica Bertheloot, Pierre Martre, and Bruno Andrieu* 1707

## SYSTEMS BIOLOGY, MOLECULAR BIOLOGY, AND GENE REGULATION

- <sup>[C][OA]</sup> $\beta$ -Subunits of the SnRK1 Complexes Share a Common Ancestral Function Together with Expression and Function Specificities; Physical Interaction with Nitrate Reductase Specifically Occurs via AKIN $\beta$ 1-Subunit. *Cécile Polge, Mathieu Jossier, Pierre Crozet, Lionel Gissot, and Martine Thomas* 1570
- <sup>[C][W][OA]</sup>Transcriptional Profiling of Mature Arabidopsis Trichomes Reveals That *NOECK* Encodes the MIXTA-Like Transcriptional Regulator MYB106. *Marc J. Jakoby, Doris Falkenhan, Michael T. Mader, Ginger Brininstool, Elisabeth Wischnitzki, Nicole Platz, Andrew Hudson, Martin Hülskamp, John Larkin, and Arp Schnittger* 1583
- <sup>[W]</sup>Subclade of Flavin-Monooxygenases Involved in Aliphatic Glucosinolate Biosynthesis. *Jing Li, Bjarne Gram Hansen, James A. Ober, Daniel J. Kliebenstein, and Barbara Ann Halkier* 1721

## CORRECTIONS

- The Arabidopsis Phosphatidylinositol 3-Kinase Is Important for Pollen Development. *Y. Lee, E.-S. Kim, Y. Choi, I. Hwang, C.J. Staiger, Y.-Y. Chung, and Y. Lee* 1734
- Comparative Proteomics of Chloroplast Envelopes from C<sub>3</sub> and C<sub>4</sub> Plants Reveals Specific Adaptations of the Plastid Envelope to C<sub>4</sub> Photosynthesis and Candidate Proteins Required for Maintaining C<sub>4</sub> Metabolite Fluxes. *A. Bräutigam, S. Hoffmann-Benning, and A.P.M. Weber*

<sup>[C]</sup> Some figures in this article are displayed in color online but in black and white in the print edition.

<sup>[W]</sup> Indicates Web-only data.

<sup>[OA]</sup> Open Access articles can be viewed online without a subscription.